



NUCLEAR REGULATORY COMMISSION

[Docket Nos. 50-289 and 50-320; NRC-2020-0217]

Exelon Generation Company, LLC

Three Mile Island Nuclear Station, Units 1 and 2

AGENCY: Nuclear Regulatory Commission.

ACTION: Exemption; issuance.

SUMMARY: The U.S. Nuclear Regulatory Commission (NRC) has issued exemptions in response to a request from Exelon Generation Company, LLC (Exelon, the licensee) regarding certain emergency planning (EP) requirements. The exemptions eliminate the requirements to maintain an offsite radiological emergency preparedness plan and reduce the scope of onsite EP activities at the Three Mile Island Nuclear Station, Units 1 and 2 (TMI), based on the reduced risks of accidents that could result in an offsite radiological release at a decommissioning nuclear power reactor.

DATES: The exemptions were issued on December 1, 2020.

ADDRESSES: Please refer to Docket ID **NRC-2020-0217** when contacting the NRC about the availability of information regarding this document. You may obtain publicly available information related to this document using any of the following methods:

- **Federal Rulemaking Web Site:** Go to <https://www.regulations.gov> and search for Docket ID **NRC-2020-0217**. Address questions about Docket IDs to Jennifer Borges; telephone: 301-287-9127; e-mail: Jennifer.Borges@nrc.gov. For technical questions, contact the individual listed in the **FOR FURTHER INFORMATION**

CONTACT section of this document.

- **NRC's Agencywide Documents Access and Management System**

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contact the NRC's Public Document Room (PDR) reference staff at 1-800-397-4209, 301-415-4737, or by e-mail to pdr.resource@nrc.gov. The ADAMS accession number for each document referenced (if it is available in ADAMS) is provided the first time that it is mentioned in this document.

- **Attention:** The PDR, where you may examine and order copies of public documents is currently closed. You may submit your request to the PDR via e-mail at PDR.Resource@nrc.gov or call 1-800-397-4209 between 8:00 a.m. and 4:00 p.m. (EST), Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: Theodore Smith, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington DC 20555-0001; telephone: 301-415-6721; e-mail: Theodore.Smith@nrc.gov.

SUPPLEMENTARY INFORMATION: The text of the exemptions are attached.

Dated: December 1, 2020.

For the Nuclear Regulatory Commission.

Bruce Watson, Chief,
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NUCLEAR REGULATORY COMMISSION

[Docket Nos. 50-289 and 50-320]

Exelon Generation Company, LLC

Three Mile Island Nuclear Station, Units 1 and 2

Exemptions

I. Background.

Exelon Generation Company, LLC (Exelon, the licensee) is the holder of U.S. Nuclear Regulatory Commission (NRC, the Commission) Renewed Facility Operating License No. DPR-50 for Three Mile Island Nuclear Station, Unit 1 (TMI-1). Three Mile Island Nuclear Station, Unit 2 (TMI-2) has a possession-only license and is currently maintained in accordance with the NRC-approved SAFSTOR condition known as post-defueling monitored storage. Exelon maintains the emergency planning responsibilities for TMI-2, which is owned by GPU Nuclear, Inc., through a service agreement. These licenses are subject to the rules, regulations, and orders of the NRC. The licensed facilities consist of permanently shutdown pressurized-water reactors (PWR) located in Dauphin County, Pennsylvania.

By letter dated June 20, 2017 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML17171A151), Exelon submitted a certification to the NRC that it would permanently cease power operations at TMI-1 on or about September 30, 2019. On September 20, 2019, Exelon permanently ceased power operations at TMI-1. By letter dated September 26, 2019 (ADAMS Accession No. ML19269E480), Exelon certified the permanent removal of fuel from the TMI-1 reactor vessel. In accordance with paragraph 50.82(a)(2) of Title 10 of the Code of Federal Regulations (10 CFR), upon the docketing of these certifications, the license for TMI-1 no longer

authorizes operation of the reactor or emplacement or retention of fuel into the reactor vessel. The facility is still authorized to possess and store irradiated (i.e., spent) nuclear fuel. Spent fuel is currently stored onsite in the TMI-1 spent fuel pool (SFP). A dry cask independent spent fuel storage installation is under construction to store the TMI-1 spent fuel. Since the license for TMI-2 had previously been modified to allow possession but not operation of the facility, the certifications of permanent cessation of operations and permanent removal of fuel are, by rule, deemed to have been submitted for TMI-2. Spent fuel for TMI-2 has already been removed from the site, though residual contamination and radiological materials exist.

During normal power reactor operations, the forced flow of water through the reactor coolant system removes heat generated by the reactor. The reactor coolant system, operating at high temperatures and pressures, transfers this heat through the steam generator tubes converting non-radioactive feedwater to steam, which then flows to the main turbine generator to produce electricity. Many of the accident scenarios postulated in the updated safety analysis reports for operating power reactors involve failures or malfunctions of systems, which could affect the fuel in the reactor core and, in the most severe postulated accidents, would involve the release of large quantities of fission products. With the permanent cessation of operations and the permanent removal of the fuel from the reactor vessels at TMI, such accidents are no longer possible. The reactor, reactor coolant system, and supporting systems are no longer in operation and have no function related to the storage of the spent fuel. Therefore, emergency planning (EP) provisions for postulated accidents involving failure or malfunction of the reactor, reactor coolant system, or supporting systems are no longer applicable.

The EP requirements of 10 CFR 50.47, "Emergency plans," and Appendix E to 10 CFR Part 50, "Emergency Planning and Preparedness for Production and Utilization Facilities," continue to apply to nuclear power reactors that have permanently ceased operation and have permanently removed all fuel from the reactor vessel. There are no

explicit regulatory provisions distinguishing EP requirements for a power reactor that is permanently shut down and defueled from those for a reactor that is authorized to operate. To reduce or eliminate EP requirements that are no longer necessary due to the decommissioning status of the facility, Exelon must obtain exemptions from those EP regulations. Only then can Exelon modify the TMI emergency plan to reflect the reduced risk associated with the permanently shutdown and defueled condition of TMI.

II. Request/Action.

By letter dated July 1, 2019 (ADAMS Accession No. ML19182A104), Exelon requested exemptions from certain EP requirements in 10 CFR Part 50 for TMI. Specifically, Exelon requested exemptions from certain planning standards in 10 CFR 50.47(b) regarding onsite and offsite radiological emergency preparedness plans for nuclear power reactors; from certain requirements in 10 CFR 50.47(c)(2) for the establishment of plume exposure and ingestion pathway emergency planning zones for nuclear power reactors; and from certain requirements in 10 CFR Part 50, Appendix E, Section IV, which establish the elements that make up the content of emergency plans. In letters dated October 9, 2019, and December 10, 2019 (ADAMS Accession Nos. ML19282C285 and ML19344C115, respectively), Exelon provided supplemental information and responses to the NRC staff's requests for additional information concerning the proposed exemptions.

The information provided by Exelon included justifications for each exemption requested. The exemptions requested by Exelon would eliminate the requirements to maintain formal offsite radiological emergency preparedness plans reviewed by the Federal Emergency Management Agency (FEMA) under the requirements of 44 CFR Part 350 and would reduce the scope of onsite EP activities at TMI. The licensee stated that the application of all of the standards and requirements in 10 CFR 50.47(b), 10 CFR 50.47(c), and 10 CFR Part 50, Appendix E is not needed for adequate emergency

response capability, based on the substantially lower onsite and offsite radiological consequences of accidents still possible at the permanently shutdown and defueled facility, as compared to an operating facility. If offsite protective actions were needed for a highly unlikely beyond-design-basis accident that could challenge the safe storage of spent fuel at TMI, provisions exist for offsite agencies to take protective actions using a comprehensive emergency management plan (CEMP) under the National Preparedness System to protect the health and safety of the public. A CEMP in this context, also referred to as an emergency operations plan, is addressed in FEMA's Comprehensive Preparedness Guide 101, "Developing and Maintaining Emergency Operations Plans," which is publicly available at http://www.fema.gov/pdf/about/divisions/npd/CPG_101_V2.pdf. Comprehensive Preparedness Guide 101 is the foundation for State, territorial, Tribal, and local EP in the United States. It promotes a common understanding of the fundamentals of risk-informed planning and decisionmaking and helps planners at all levels of government in their efforts to develop and maintain viable, all-hazards, all-threats emergency plans. An emergency operations plan is flexible enough for use in all emergencies. It describes how people and property will be protected; details who is responsible for carrying out specific actions; identifies the personnel, equipment, facilities, supplies and other resources available; and outlines how all actions will be coordinated. A CEMP is often referred to as a synonym for "all-hazards planning."

III. Discussion.

In accordance with 10 CFR 50.12, "Specific exemptions," the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 50 when: (1) the exemptions are authorized by law, will not present an undue risk to public health and safety, and are consistent with the common defense and security; and (2) any of the special circumstances listed in 10

CFR 50.12(a)(2) are present. These special circumstances include, among other things, that the application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule.

As noted previously, the EP regulations contained in 10 CFR 50.47(b) and Appendix E to 10 CFR Part 50 apply to both operating and shutdown power reactors. The NRC has consistently acknowledged that the risk of an offsite radiological release at a power reactor that has permanently ceased operations and permanently removed fuel from the reactor vessel is significantly lower, and the types of possible accidents are significantly fewer, than at an operating power reactor. However, the EP regulations do not recognize that once a power reactor permanently ceases operation, the risk of a large radiological release from credible emergency accident scenarios is significantly reduced. The reduced risk for any significant offsite radiological release is based on two factors. One factor is the elimination of accidents applicable only to an operating power reactor, resulting in fewer credible accident scenarios. The second factor is the reduced short-lived radionuclide inventory and decay heat production due to radioactive decay. Due to the permanently defueled status of the reactor, no new spent fuel will be added to the SFP and the radionuclides in the current spent fuel will continue to decay as the spent fuel ages. The spent fuel will produce less heat due to radioactive decay, increasing the available time to mitigate a loss of water inventory from the SFP. The NRC's NUREG/CR-6451, "A Safety and Regulatory Assessment of Generic BWR [Boiling Water Reactor] and PWR Permanently Shutdown Nuclear Power Plants," dated August 1997 (ADAMS Accession No. ML082260098), and the NRC's NUREG-1738, "Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants," dated February 2001 (ADAMS Accession No. ML010430066), confirmed that for permanently shutdown and defueled power reactors that are bounded by the assumptions and conditions in the report, the risk of offsite radiological release is significantly less than for an operating power reactor.

In the past, EP exemptions similar to those requested for TMI have been granted to permanently shutdown and defueled power reactor licensees. However, the exemptions did not relieve the licensees of all EP requirements. Rather, the exemptions allowed the licensees to modify their emergency plans commensurate with the credible site-specific risks that were consistent with a permanently shutdown and defueled status. Specifically, the NRC's approval of these prior exemptions was based on the licensee's demonstration that: (1) the radiological consequences of design-basis accidents would not exceed the limits of the U.S. Environmental Protection Agency (EPA) early phase Protective Action Guides (PAGs) of one roentgen equivalent man at the exclusion area boundary; and (2) in the highly unlikely event of a beyond-design-basis accident resulting in a loss of all modes of heat transfer from the fuel stored in the SFP, there is sufficient time to initiate appropriate mitigating actions, and if needed, for offsite authorities to implement offsite protective actions using a CEMP approach to protect the health and safety of the public.

With respect to design-basis accidents at TMI, the licensee provided an analysis demonstrating that following permanent cessation of power operations at TMI-1, the radiological consequences of the remaining design-basis accidents with potential for offsite radiological release (a fuel handling accident in the Fuel Handling Building, where the SFP is located for TMI-1, and a fire in the Reactor Building with the Reactor Building Purge System in operation for TMI-2) will not exceed the limits of the EPA PAGs at the exclusion area boundary.

With respect to beyond-design-basis accidents at TMI, the licensee analyzed a drain down of the SFP water that would effectively impede any decay heat removal. The analysis demonstrates that at 488 days (approximately 16 months) after permanent cessation of power operations, there would be 10 hours after the assemblies have been uncovered until the limiting fuel assembly (for decay heat and adiabatic heat-up analysis) reaches 900 degrees Celsius ($^{\circ}\text{C}$), the temperature used to assess the potential onset of fission product release. The analysis conservatively assumed that the

heat-up time starts when the SFP has been completely drained, although it is likely that site personnel will start to respond to an incident when drain down starts. The analysis also does not consider the period of time from the initiating event causing loss of SFP water inventory until cooling is lost.

The NRC reviewed the licensee's justification for the requested exemptions against the criteria in 10 CFR 50.12(a) and determined, as described below, that the criteria in 10 CFR 50.12(a) will be met, and that the exemptions should be granted 488 days after TMI-1 has permanently ceased power operations. An assessment of the Exelon EP exemptions is described in SECY-20-0041, "Request by Exelon Generation Company, LLC for Exemptions from Certain Emergency Planning Requirements for the Three Mile Island Nuclear Station," dated May 5, 2020 (ADAMS Package Accession No. ML19311C762). The Commission approved the NRC staff's recommendation to grant the exemptions in the staff requirements memorandum to SECY-20-0041, dated July 27, 2020 (ADAMS Accession No. ML20209A439). Descriptions of the specific exemptions requested by Exelon and the NRC staff's basis for granting each exemption are provided in SECY-20-0041. The NRC staff's detailed review and technical basis for the approval of the specific EP exemptions requested by Exelon are provided in the NRC staff's safety evaluation associated with this exemption (ADAMS Accession No. ML19311C762).

A. The Exemption is Authorized by Law.

The licensee has proposed exemptions from certain EP requirements in 10 CFR 50.47(b), 10 CFR 50.47(c)(2), and 10 CFR Part 50, Appendix E, Section IV, that would allow Exelon to revise the TMI Emergency Plan to reflect the permanently shutdown and defueled condition of the facility. As stated above, in accordance with 10 CFR 50.12, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 50. The NRC staff has determined that granting of the licensee's proposed exemptions will not result in a violation of the Atomic Energy Act of 1954, as amended, or the NRC's regulations.

Therefore, the exemptions are authorized by law.

B. The Exemption Presents no Undue Risk to Public Health and Safety.

As stated previously, Exelon provided an analysis that shows that the radiological consequences of design-basis accidents will not exceed the limits of the EPA early phase PAGs at the exclusion area boundary. Therefore, formal offsite radiological emergency preparedness plans required under 10 CFR Part 50 will no longer be needed for protection of the public beyond the exclusion area boundary, based on the radiological consequences of design-basis accidents still possible at TMI 488 days after TMI-1 has permanently ceased power operations.

Although highly unlikely, there is one postulated beyond-design-basis accident that might result in significant offsite radiological releases. However, NUREG-1738 confirms that the risk of beyond-design-basis accidents is greatly reduced at permanently shutdown and defueled reactors. The NRC staff's analyses in NUREG-1738 conclude that the event sequences important to risk at permanently shutdown and defueled power reactors are limited to large earthquakes and cask drop events. For EP assessments, this is an important difference relative to operating power reactors, where typically a large number of different sequences make significant contributions to risk. As described in NUREG-1738, relaxation of offsite EP requirements in 10 CFR Part 50 beyond a few months after shutdown resulted in only a small change in risk. The report further concludes that the change in risk due to relaxation of offsite EP requirements is small because the overall risk is low, and because even under current EP requirements for operating power reactors, EP was judged to have marginal impact on evacuation effectiveness for the severe earthquakes that dominate SFP risk. All other sequences including cask drops (for which offsite radiological emergency preparedness plans are expected to be more effective) are too low in likelihood to have a significant impact on risk.

Therefore, granting exemptions to eliminate the requirements of 10 CFR Part 50 to maintain offsite radiological emergency preparedness plans and to reduce the scope

of onsite EP activities will not present an undue risk to the public health and safety.

C. The Exemption is Consistent with the Common Defense and Security.

The requested exemptions only involve EP requirements under 10 CFR Part 50 and will allow Exelon to revise the TMI Emergency Plan to reflect the permanently shutdown and defueled condition of the facility. Physical security measures at TMI are not affected by the requested EP exemptions. The discontinuation of formal offsite radiological emergency preparedness plans and the reduction in scope of the onsite EP activities at TMI will not adversely affect Exelon's ability to physically secure the site or protect special nuclear material. Therefore, the proposed exemptions are consistent with common defense and security.

D. Special Circumstances.

Special circumstances, in accordance with 10 CFR 50.12(a)(2)(ii), are present whenever application of the regulation in the particular circumstances is not necessary to achieve the underlying purpose of the rule. The underlying purpose of 10 CFR 50.47(b), 10 CFR 50.47(c)(2), and 10 CFR Part 50, Appendix E, Section IV, is to provide reasonable assurance that adequate protective measures can and will be taken in the event of a radiological emergency, to establish plume exposure and ingestion pathway emergency planning zones for nuclear power plants, and to ensure that licensees maintain effective offsite and onsite radiological emergency preparedness plans. The standards and requirements in these regulations were developed by considering the risks associated with operation of a power reactor at its licensed full-power level. These risks include the potential for a reactor accident with offsite radiological dose consequences.

As discussed previously in Section III, because TMI will be permanently shut down and defueled, there will no longer be a risk of a significant offsite radiological release from a design-basis accident exceeding EPA early phase PAGs at the exclusion area boundary and the risk of a significant offsite radiological release from a beyond-design-basis accident is greatly reduced when compared to an operating power reactor.

The NRC staff has confirmed the reduced risks at TMI by comparing the generic risk assumptions in the analyses in NUREG-1738 to site-specific conditions at TMI and determined that the risk values in NUREG-1738 bound the risks presented at TMI. As indicated by the results of the research conducted for NUREG-1738, and more recently for NUREG-2161, "Consequence Study of a Beyond-Design-Basis Earthquake Affecting the Spent Fuel Pool for a U.S. Mark I Boiling Water Reactor," dated September 2014 (ADAMS Accession No. ML14255A365), while other consequences can be extensive, accidents from SFPs with significant decay time have little potential to cause offsite early fatalities, even if the formal offsite radiological EP requirements were relaxed. The licensee's analysis of a beyond-design-basis accident involving a complete loss of SFP water inventory, based on an adiabatic heat-up analysis of the limiting fuel assembly for decay heat, shows that 488 days after permanent cessation of power operations at TMI-1, the time for the limiting fuel assembly to reach 900 °C is at least 10 hours after the assemblies have been uncovered assuming a loss of all cooling means.

The only analyzed beyond-design-basis accident scenario that progresses to a condition where a significant offsite release might occur, involves the highly unlikely event where the SFP drains in such a way that all modes of cooling or heat transfer are assumed to be unavailable, which is referred to as an adiabatic heat-up of the spent fuel. The licensee's analysis of this beyond-design-basis accident shows that 488 days after permanent cessation of power operations at TMI-1, at least 10 hours would be available between the time that all cooling means are lost to the fuel (at which time adiabatic heat-up is conservatively assumed to begin), until the fuel cladding reaches a temperature of 1652 degrees Fahrenheit (900 °C), which is the temperature associated with rapid cladding oxidation and the potential for a significant radiological release. This analysis conservatively does not include the period of time from the initiating event causing a loss of SFP water inventory until all cooling means are lost.

The NRC staff has verified Exelon's analyses and its calculations. The analyses provide reasonable assurance that in granting the requested exemptions to Exelon,

there is no design-basis accident that will result in an offsite radiological release exceeding the EPA early phase PAGs at the exclusion area boundary. In the highly unlikely event of a beyond-design-basis accident affecting the SFP that results in a complete loss of heat removal via all modes of heat transfer, there will be over 10 hours available before an offsite release might occur and, therefore, at least 10 hours to initiate appropriate mitigating actions to restore a means of heat removal to the spent fuel. If a radiological release were projected to occur under this highly unlikely scenario, a minimum of 10 hours is considered sufficient time for offsite authorities to implement protective actions using a CEMP approach to protect the health and safety of the public. Exemptions from the offsite EP requirements in 10 CFR Part 50 have previously been approved by the NRC when the site-specific analyses show that at least 10 hours is available following a loss of SFP coolant inventory accident with no air cooling (or other methods of removing decay heat) until cladding of the hottest fuel assembly reaches the rapid oxidation temperature. The NRC staff concluded in its previously granted exemptions, as it does with Exelon's requested EP exemptions, that if a minimum of 10 hours is available to initiate mitigative actions consistent with plant conditions or, if needed, for offsite authorities to implement protective actions using a CEMP approach, then formal offsite radiological emergency preparedness plans, required under 10 CFR Part 50, are not necessary at permanently shutdown and defueled facilities.

Additionally, TMI committed to maintaining SFP makeup strategies in its application. The multiple strategies for providing makeup to the SFP include: using existing plant systems for inventory makeup; an internal strategy that relies on the fire protection system with redundant pumps (one diesel-driven and one electric motor-driven); and an off-site fire truck that can take suction from the Susquehanna River. These strategies will continue to be required as condition 2.c.(17), "Mitigation Strategy License Condition," of the TMI-1 Renewed Facility Operating License. Considering the very low probability of beyond-design-basis accidents affecting the SFP, these diverse strategies provide multiple methods to obtain additional makeup or spray to the SFP

before the onset of any postulated offsite radiological release.

For all of the reasons stated above, the NRC staff finds that the licensee's requested exemptions meet the underlying purpose of all of the standards in 10 CFR 50.47(b), and requirements in 10 CFR 50.47(c)(2) and 10 CFR Part 50, Appendix E, and satisfy the special circumstances provision in 10 CFR 50.12(a)(2)(ii) in view of the greatly reduced risk of offsite radiological consequences associated with the permanently shutdown and defueled state of the TMI facility 488 days after permanent cessation of power operations of TMI-1.

The NRC staff has concluded that the exemptions being granted by this action will maintain an acceptable level of emergency preparedness at TMI and, if needed, that there is reasonable assurance that adequate offsite protective measures can and will be taken by State and local government agencies using a CEMP approach in the highly unlikely event of a radiological emergency at TMI. Since the underlying purpose of the rules, as exempted, would continue to be achieved, even with the elimination of the requirements under 10 CFR Part 50 to maintain formal offsite radiological emergency preparedness plans and the reduction in the scope of the onsite emergency planning activities at TMI, the special circumstances required by 10 CFR 50.12(a)(2)(ii) exist.

E. Environmental Considerations.

In accordance with 10 CFR 51.31(a), the Commission has determined that the granting of this exemption will not have a significant effect on the quality of the human environment as discussed in the NRC staff's Finding of No Significant Impact and associated Environmental Assessment published in the Federal Register on September 22, 2020 (85 FR 59565).

IV. Conclusions.

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12, Exelon's request for exemptions from certain EP requirements in 10 CFR 50.47(b), 10

CFR 50.47(c)(2), and 10 CFR Part 50, Appendix E, Section IV, and as summarized in Enclosure 2 to SECY-20-0041, are authorized by law, will not present an undue risk to the public health and safety, and are consistent with the common defense and security. Also, special circumstances are present. Therefore, the Commission hereby grants Exelon's exemptions from certain EP requirements in 10 CFR 50.47(b), 10 CFR 50.47(c)(2), and 10 CFR Part 50, Appendix E, Section IV, as discussed and evaluated in detail in the NRC staff's safety evaluation associated with this exemption. The exemptions are effective as of 488 days after permanent cessation of power operations of TMI-1.

Dated: December 1, 2020

For the Nuclear Regulatory Commission.

Patricia K. Holahan, Director,
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Office of Nuclear Material Safety and Safeguards.

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